CLAIMS

What is claimed is:

1. An ultrasonic transducer, comprising:

an ultrasonic sensor having a plurality of elements; and

an integrated circuit formed on a wafer, the wafer including a plurality of cavities defining a plurality of posts such that the cavities alter the acoustic impedance of the wafer, and wherein the integrated circuit is joined to the ultrasonic sensor.

2. The transducer of claim 1, wherein the ultrasonic sensor comprises piezoelectric ceramic material.

3. The transducer of claim 1, wherein the ultrasonic sensor comprises a micro-machined ultrasonic transducer (MUT).

4. The transducer of claim 1, wherein each elements of the ultrasonic sensor is located over one of the plurality of posts.

5. The transducer of claim 1, wherein each of the elements of the ultrasonic sensor are located over one of the plurality of cavities.

6. The transducer of claim 1, wherein the cavities reduce acoustic energy traveling laterally in the wafer.

7. The transducer of claim 1, wherein the wafer is silicon.

8. The transducer of claim 1, wherein the wafer is germanium.

9. The transducer of claim 1, wherein the cavities are designed to allow the acoustic impedance of the wafer to match the acoustic impedance of the transducer elements.

10. The transducer of claim 1, wherein altering the acoustic impedance of the wafer increases the effective bandwidth of the transducer elements.

11. The transducer of claim 1, wherein the wafer further comprises:

a first wafer component including the plurality of cavities; and

a second wafer component bonded to the first wafer component.

12. A method for forming an ultrasonic transducer, the method comprising the steps of:

forming a plurality of cavities in a first wafer component such that the cavities define the acoustic impedance of the first wafer component and such that the cavities define a plurality of posts;

joining a second wafer component to the first wafer component;

forming an integrated circuit on a surface of the second wafer component;

forming an ultrasonic sensor having a plurality of elements; and

joining the ultrasonic sensor to the integrated circuit.

13. The method of claim 12, wherein the ultrasonic sensor comprises piezoelectric ceramic material.

14. The method of claim 12, wherein the ultrasonic sensor comprises a micro-machined ultrasonic transducer (MUT).

15. The method of claim 12, further comprising the step of locating each of the elements of the ultrasonic sensor over one of the plurality of posts.

16. The method of claim 12, further comprising the step of locating each of the elements of the ultrasonic sensor over one of the plurality of cavities.

17. The method of claim 12, wherein the cavities reduce acoustic energy traveling laterally in the substrate.

18. The method of claim 12, wherein the first wafer component and the second wafer component are silicon.

19. The method of claim 12, wherein the first wafer component and the second wafer component are germanium.

20. The method of claim 12, wherein the first wafer component and the second wafer component form an acoustically variable wafer.

21. The method of claim 20, further comprising the step of designing the cavities to alter the acoustic impedance of the wafer to match the acoustic impedance of the transducer elements.

22. The method of claim 20, further comprising the step of altering the acoustic impedance of the wafer to increase the effective bandwidth of the transducer elements.

23. An acoustically variable wafer, comprising:

a first wafer component having a plurality of cavities defining a plurality of posts such that the cavities alter the acoustic impedance of the first wafer component ; and

a second wafer component bonded to the first wafer component , the first wafer component and the second wafer component forming the wafer, where the wafer has a variable acoustic impedance.

24. The wafer of claim 23, further comprising an integrated circuit formed over a surface of the wafer.

25. The wafer of claim 23, further comprising a micro-machined ultrasonic transducer formed over a surface of the wafer.

26. The wafer of claim 23, wherein the wafer comprises a circuit board.